

## **Adherence to recommended nutrition-related behaviours for preschoolers at home and early education services**

### **Abstract**

### **Objective**

Behaviours by caregivers during the preschool period can influence nutrition and the development of life-long eating habits, e.g. eating with children, role-modeling healthy behaviours, and not hurrying meals. This study examines the congruence of parental and teacher nutrition-related behaviours in home and education settings.

### **Design**

Cross-sectional analyses of data (overall and by socio-economic position) from telephone interviews with mothers and an online survey of managers/head teachers of education services.

### **Settings**

New Zealand homes and licensed daycare centres and kindergartens.

### **Subjects**

Analyses include 1181 children both enrolled in the Growing Up in New Zealand cohort study and attending a licensed childcare service at 45-months-of-age.

### **Results**

There was no relationship between adherences to recommended nutrition-related behaviours at home and in the early education service. Half of children with high adherence at home attended a service with low adherence. 60% of children with low adherence at home attended a childcare service with moderate or high adherence. A larger proportion of children in deprived communities attended a service with high adherence to recommended nutrition-related behaviours compared to children living in the least deprived communities (20% and 12% respectively).

### **Conclusions**

Some children attend an early education service that may undermine healthy eating behaviours at home, or reinforce unhealthy behaviours at home. For others, a ‘protective effect’ may be conferred when recommended nutrition behaviours are learnt in the early education setting when absent at home. This research underscore the importance of health-promoting environments in early education settings for establishing healthy eating habits.

**Key words:** eating behaviours, eating habits, child care, child nutrition, food, education

## **Introduction**

Early childhood is widely regarded as the ideal time to develop behaviours that assist with life long healthy eating patterns. Eating habits and food preferences are becoming established in the preschool years, and early childhood is characterized by ‘high plasticity’ and ‘rapid transitions’ that can effect behavioural change<sup>(1)</sup>. Parents and caregivers have a high degree of control over a child’s food environment, and a young child’s dietary pattern and behaviours are therefore easier to influence than older children and adults. Additionally, many eating behaviours have been found to track from infancy to preschool<sup>(2)</sup>, early childhood through childhood<sup>(3)</sup>, from childhood to adolescence<sup>(4)</sup> and into adulthood<sup>(5)</sup>, confirming the importance of developing healthy behaviours early in life.

Families are a key social environment for the development of eating patterns and food preferences<sup>(6,7)</sup>. Several behaviours that occur in the home have been found to be positively associated with a healthy diet in early childhood: eating breakfast at home<sup>(8-10)</sup>; eating together as a family<sup>(11)</sup>; positive parental role-modeling<sup>(12-14)</sup>; encouraging balance and variety<sup>(15)</sup>; and not watching TV or using screens while eating<sup>(16)</sup>. Furthermore, there is evidence that some of these recommended behaviours may protect against the development of child overweight and obesity<sup>(17-19)</sup>.

Nutrition-related behaviours are embedded within a family’s socio-economic context and influenced by resources available to them<sup>(20)</sup>. However, little is known about adherence to recommended nutrition-related behaviours (referred to as RNB in this paper) by socio-economic position<sup>(21,22)</sup>. The New Zealand Health Survey found significant socio-economic differences in RNB and dietary intake for children aged 2-14 years: those living in areas of high deprivation were 2.5 times more likely to have eaten breakfast at home less than five days in the past week, 2.8 times more likely to have eaten fast food three or more times in the past week, 3.5 times more likely to have had three or more fizzy drinks in the past week, and 20% less likely to have met the daily vegetable and fruit intake recommendation compared to children living in the least deprived areas<sup>(23)</sup>. Children living in areas of high deprivation in New Zealand are three times more likely than children living in areas of low deprivation to be classified as obese based on their body mass, with one in five children in areas of high deprivation in the obese category<sup>(23)</sup>.

For children with less-than-optimal home nutrition environments, out-of-home early education may serve as a ‘protective’ environment, ameliorating or buffering preferences and behaviours learned at

home<sup>(24)</sup>. As the majority of young children in high-income countries are now enrolled in a day care centre or kindergarten prior to formal schooling, these early education settings have become an important component of children's food and nutrition environments<sup>(20)</sup>. Systematic reviews have found positive changes in young children's eating behaviours occur when early childhood teachers engage in mealtime practices promoting self-regulation and using role-modelling, although the lack of high quality studies made it difficult to define exactly which mealtime practices should be recommended<sup>(25)</sup>. Current guidelines for early education services in New Zealand<sup>(26)</sup>, Australia<sup>(27)</sup>, the USA<sup>(28)</sup> and the UK<sup>(29)</sup> consider the following nutrition-related behaviours to be 'best practice': staff sit with children while they eat, and eat the same food as children; staff talk to children about food at mealtimes; staff promote water consumption and encourage children to try unfamiliar foods; staff never hurry children to finish eating, never use food as a reward, and never restrict or deny food as a punishment. Nutrition concepts learnt in early education environments (e.g. the health benefits from eating fruit and vegetables) are often discussed by children at home and can impact family eating behaviours and practices<sup>(30)</sup>. In addition, several studies have reported positive nutritional outcomes when children grow fruit and vegetables, and prepare, cook or bake food in the early education setting<sup>(31-34)</sup>. A recent study found the most important RNB for improving children's dietary intake in childcare centres were educators' modeling, nutrition education and not using food as rewards<sup>(35)</sup>.

Ecological systems theory—originally proposed by Bronfenbrenner<sup>(36)</sup>—describes the interrelationship between the home and early education environment as a 'mesosystem' influencing child development. Most child development research considers concordance in the mesosystem of home and early education to be advantageous for child development (e.g. when home cultural practices and language are reflected and celebrated within the early education service then children feel validated). However, as described above, concordance is not always preferable if a high quality early education service is providing positive experiences, or quality food for example, that is not available within the home. Gubbels et al. state that quantitative studies are required that explore the mesosystem created by interactions between the home and early education to further elucidate the effect of environments on child nutrition and activity behaviours<sup>(37)</sup>.

This paper describes parent and teacher adherence to RNB for a sample of 45-month-old New Zealand children in both their home and early education settings, and seeks to understand the extent to which adherence is similar or dissimilar across the two environments. Based on ecological systems theory of a mesosystem between home and early education for children<sup>(36)</sup>, we hypothesize

overall concordance in the nutrition-related behaviours experienced by children across these settings. We further test if children who experience home environments with low adherence to RNB attend a health-promoting early education environment, which may buffer or ameliorate their home experiences. Furthermore, we explore adherence to RNB by level of neighborhood deprivation to determine if children living in disadvantaged communities experience a ‘protective’ effect by attending early education services that promote healthy behaviours.

## **Method**

### **Data sources**

This study utilizes data from two sources: the Growing Up in New Zealand (GUiNZ) longitudinal study<sup>(38)</sup> and the Kai Time in ECE survey<sup>(39)</sup>. GUiNZ is the largest longitudinal study in New Zealand, following the health and development of a cohort of children born in 2009/10. The study recruited pregnant women from three district health board regions of New Zealand (Auckland, Counties Manukau and Waikato)<sup>(38)</sup>. The fourth data collection wave (DCW4) for GUiNZ was collected via a telephone call between February 2013 and January 2014 with 6211 mothers when their child was 45-months-of-age; over 90% retention across the preschool period<sup>(40)</sup>. The Growing Up in New Zealand cohort is broadly analogous to all New Zealand births over a similar time period, although slightly more ethnically and socio-demographically diverse<sup>(41)</sup>. Kai Time in ECE was a 65-item online survey of managers and head teachers of 257 licensed early education services in the same three district health board regions of New Zealand where the GUiNZ cohort were recruited, undertaken May to June 2014. All licensed services in this area were invited by email to take part. The 257 (30.3%) services that participated were broadly representative of all licensed services in the area, with the exception of Māori cultural immersion centres (Kōhanga Reo) that were under-represented<sup>(39)</sup>.

### **Linkage of the datasets**

Data from the two sources were matched to create a subsample of 1181 children whose main childcare provider as reported by the mother in DCW4 had taken part in the Kai Time in ECE Survey (Figure 1). The matching process, described in Figure 1, began with probabilistically matching of name and location provided by the mother in DCW4 with the name and location of services listed on the Ministry of Education’s Early Childhood Services Directory (August 2013), with each match manually checked or corrected. Additional matches were performed manually using Google and the Directory (Figure 1). The Directory Service IDs were then exact matched

with Directory Service IDs in the Kai Time in ECE dataset. In total, 1181 children from DCW4 were successfully matched to 218 early education services from Kai Time in ECE (mean 5.4 children in each ECE, range 1-22, SD 3.7). For analysis purposes, data were treated as cross-sectional, that is, assuming no change between data collection periods.

**Figure 1: Process for matching Early Education Service data collected in the Kai Time in ECE Survey to the Growing Up in New Zealand DCW4 data**

[insert Figure 1 here]

### **Home variables**

During the GUINZ DCW4 interview, mothers reported the frequency of eight recommended nutrition behaviours (RNB): child eats breakfast daily; family sits together for main meal; mealtimes are seen as a time to talk to each other; mealtimes are never rushed; child eats same food as parents for their main meal; child eats a variety of food; family mealtimes are enjoyable; screens/television rarely or never on when child is eating. Response categories (indicated in Table 1) were dichotomized and summed to create a count out of 8 for adherence. Observations with missing data (refused or don't know responses) were excluded from relevant analyses (n=15 or less). Additional child demographic data from the fifth GUINZ data collection wave (gender, main ethnic group, socioeconomic position, mother's employment) collected face-to-face with mothers in the home when the child was 54-months old was matched to the subsample. Ethnic group was mother-reported main ethnic group that the child identifies with, using Statistics New Zealand Level 1 classification<sup>(42)</sup>. Socio-economic position was ascribed using the New Zealand Deprivation Index (NZDep2013) based on home address<sup>(38)</sup>. NZDep2013 combines nine variables from the 2013 census to reflect eight dimensions of deprivation, assigning a score for each meshblock (small geographical unit containing approximately 60-110 people). Categories of NZDep2013 deciles describe households as being in the 30% least deprived areas (low deprivation) to the 30% most deprived areas (high deprivation). NZDep2013 has strong construct and criterion validity and is a common measure of socioeconomic position in health research<sup>(38)</sup>.

### **Early education variables**

The head teacher or manager who participated in the Kai Time in ECE survey reported the frequency of eight RNB: staff sit with children while they eat; staff eat the same food as children; staff talk to children about food at mealtimes; staff never hurry children to finish eating; staff promote water consumption; staff never use food as a reward or punish by restricting or denying

access to food; children make, bake or cook food regularly; children participate in gardening activities. Response categories (indicated in Table 1) were dichotomized and summed to create a count out of 8 for adherence. Centre characteristics of type, District Health Board region, number of students enrolled and proportion of Māori and Pacific students were taken from the ECE Service Directory. Teacher to child ratio, proportion of teachers fully qualified and participation in the Heart Foundation's Healthy Heart Award (the largest health promotion programme in early education services in New Zealand) were self-reported in the Kai Time in ECE survey. Previously reported analyses of these variables showed differences by type of early education service<sup>(39)</sup>.

### Theoretical model

A framework was created to assist with interpretation of the findings regarding adherence to RNB in the home and education setting (Figure 2). This framework was informed by Bronfenbrenner's ecological systems theory, particularly his view of the 'mesosystem' or interrelationship between the home and early education settings for children which influences child development<sup>(36)</sup>. When caregivers in both the home and early education service follow recommended behaviours (bottom right of the framework) the early education service could be said to be 'supportive' of the home nutrition environment. When both settings have low adherence to behaviours (top left of the framework) the early education service could be said to 'reinforce and legitimize' the nutrition environment in the home. When there is a mismatch between the nutrition environments in home and early education, the early education service could be said to 'challenge' the home nutrition environment or to 'undermine' it (top right and bottom left, respectively of the framework).

**Figure 2: Framework for the interpretation of alignment between nutrition-related behaviours in home and early education settings**

[insert Figure 2 here]

### Statistical analyses

The distribution of responses for RNB in the home and education setting were examined, and output by child demographics and centre characteristics respectively. To minimize potential bias, the full data sets were used to estimate prevalence of RNB. Spearman correlations were used to examine associations between RNBs in the home and education setting separately and then across the two settings where possible (for the four similar RNB variables across the two settings). The number of RNB in each setting was summed and associations were examined between number of

RNB and sociodemographic characteristics. A total of 6205 children with information on 4 or more of the home NRB were included in home analyses, and 257 early education centres contribute to analyses of the education setting. Demographics of the subsample children ( $n=1181$ ) were also compared to the full DCW4 GUiNZ cohort to estimate representativeness of the data.

Generalized linear models and chi-square tests were used to determine statistically significant differences in number of RNB by demographic characteristics. The matched subsample was used to examine the interrelationship of children's exposure to NRB across home and education settings. Children were categorized as having low (<=4), moderate (5-6), or high (7-8) adherence to RNB in the home and, separately, the education setting. We cross-tabulated RNB category at home and school, overall and by NZDep2013 category. Chi-square tests were used to identify statistically significant differences. An alpha level of 0.05 was used for all statistical tests. Data were analyzed in STATA version SE/13.1 and in SAS version 9.3.

## Results

### Nutrition-related behaviours at home

Almost all children at 45-months-of-age were reported by their mother to eat breakfast at home everyday, and 3 out of every 4 children eat a wide variety of foods, sit with their family to eat their main meal everyday, and always or mostly eat the same food as their parents (Table 1). Just over half reported that mealtimes were seen as a chance to talk to each other, and a similar proportion found family mealtimes enjoyable. Less than half of children rarely or never watched screens while eating, or were never rushed while eating at home (Table 1). All of the home recommended nutrition-related behaviours (RNB), except for never having rushed mealtimes, were positively correlated with one another at  $p<0.0001$ . For comparability with the smaller set of data on the education setting, we only report correlations of  $r=0.15$  or larger here: having main meals together as a family daily was positively correlated with children eating the same food as parents ( $r=0.20$ ) and mealtimes being seen as a time to talk ( $r=0.18$ ); the child eating a variety of foods was correlated with eating the same food as parents ( $r=0.33$ ) and mealtimes being enjoyable ( $r=0.20$ ); and mealtimes being enjoyable was also correlated with mealtimes being seen as a time to talk ( $r=0.25$ ). Never having the television on when the child was eating was correlated with mealtimes being seen as a time to talk ( $r=0.16$ ). Overall, the average number of home RNB was 5.3 out of 8, with small but statistically significant differences by gender and ethnic group, but not socioeconomic position (Table 2).

**Table 1: Recommended nutrition-related behaviours adhered to in home and early education settings for 45-month-old New Zealand children**

<b>Home behaviours<sup>1</sup></b>	<i>n</i> (%)	<b>Early education behaviours<sup>2</sup></b>	<i>n</i> (%)
Family sit together for main meal every day <sup>a</sup>	4880 (78.7)	Staff sit with children while they eat <sup>a</sup>	206 (80.2)
Child eats same food as parents <sup>b</sup>	4957 (79.9)	Staff eat and drink the same things as children <sup>b</sup>	67 (26.1)
Mealtimes are seen as a time to talk to each other <sup>c</sup>	3457 (55.8)	Staff talk to children about food at mealtimes <sup>a</sup>	127 (49.4)
Mealtimes are never rushed <sup>d</sup>	2432 (39.2)	Staff never hurry children to finish eating <sup>c</sup>	101 (39.3)
Child eats a variety of food <sup>e</sup>	4993 (80.5)	Staff encourage or promote water consumption <sup>a</sup>	217 (84.4)
Family mealtimes are enjoyable for everyone <sup>c</sup>	3579 (57.7)	Staff never use food as a reward or deny food as a punishment <sup>d</sup>	239 (93.0)
Child eats breakfast every day <sup>a</sup>	5863 (94.5)	Children make, bake or cook food at least weekly <sup>e</sup>	140 (58.8)
TV is rarely on when child is eating <sup>f</sup>	2875 (46.3)	Children garden at least weekly <sup>e</sup>	127 (59.9)
Total children	6205 (100)	Total services	257 (100)

Notes:

1. Data from Growing Up in New Zealand 45-month data collection wave (DCW4). Missing data (*n* ≤15) were excluded from individual home variable analyses.

- a) Reported as number of days a week; binary variable defined as 7 vs. <7.
- b) Response options were ‘always’, ‘almost always’, ‘sometimes’, ‘almost never’, ‘never’; binary variable defined as ‘always’ and ‘almost always’ vs. other responses
- c) Response options were ‘never’, ‘occasionally’, ‘quite often’, ‘mostly’; binary variable defined as ‘mostly’ vs. other responses
- d) Response options were ‘never’, ‘occasionally’, ‘quite often’, ‘mostly’; binary variable defined as ‘never’ vs. other responses
- e) Response options were ‘eats everything’, ‘eats most things’, ‘eats a limited variety of things’, ‘eats a very limited variety of things’; binary variable defined as ‘eats everything’ or ‘eats most things’ vs. other responses
- f) Response options were ‘always’, ‘almost always’, ‘sometimes’, ‘almost never’, ‘never’; binary variable defined as ‘never’ or ‘almost never’ vs. other responses

2. Data from Kai Time in ECE online survey of early education services; manager-reported about staff behaviours relevant to 3- and 4-year-olds. Imputation was conducted for *n*=15 services with missing nutrition behaviour variables, based on proportionate responses by type of service.

- a) Response options were ‘always’, ‘most of the time’, ‘sometimes’, ‘rarely’, ‘never’; binary variable defined as ‘always’ vs. other responses
- b) Response options were ‘always’, ‘most of the time’, ‘sometimes’, ‘rarely’, ‘never’; binary variable defined as ‘always’ and ‘most of the time’ vs. other responses
- c) Response options were ‘always’, ‘most of the time’, ‘sometimes’, ‘rarely’, ‘never’; binary variable defined as ‘never’ vs. other responses
- d) Response options were ‘never’, ‘some staff members’, ‘most staff members’, ‘all staff members’; binary variable defined as ‘never’ vs. other responses
- e) Response options were ‘daily’, ‘weekly but not every day’, ‘monthly but not every week’, ‘a few times a year’, ‘very rarely’; binary variable defined as ‘daily’ and ‘weekly but not every day’ vs. other responses

**Table 2: Average number of recommended nutrition-related behaviours<sup>1</sup> adhered to at home for 45-month-old New Zealand children**

<b>Child characteristics</b>		<b>n</b>	<b>Mean (median)</b>	<b>Standard deviation</b>	<b>Range</b>
Gender*	Male	3215	5.3 (5)	+/-1.6	0-8
	Female	2990	5.4 (6)	+/-1.6	0-8
Socio-economic status (NZDep 2013)	Low deprivation (decile 1-3)	1762	5.3 (6)	+/-1.7	0-8
	Medium deprivation (decile 4-7)	2064	5.3 (5)	+/-1.6	0-8
	High deprivation (decile 8-10)	1840	5.3 (5)	+/-1.6	0-8
Main ethnic group child identifies with*	NZ European	3522	5.4 (6)	+/-1.6	0-8
	Māori	795	5.2 (5)	+/-1.6	0-8
	Pacific (e.g. Samoan, Tongan, Cook Island Māori)	788	5.3 (5)	+/-1.6	1-8
	Asian (e.g. Chinese, Indian, Fijian Indian)	868	5.1 (5)	+/-1.6	0-8
	Other (e.g. ‘New Zealander’, MELAA, British, Australian)	214	5.5 (6)	+/-1.6	1-8
<b>Total</b>		<b>6205</b>	<b>5.3 (5)</b>	<b>+/-1.6</b>	<b>0-8</b>

\* =statistically significant difference between groups (chi square test) at  $p < 0.05$ . NZDep2013 = New Zealand Index of Neighbourhood Deprivation, MELAA = Middle Eastern, Latin American and African.

Notes: 1. Data from Growing Up in New Zealand 45-month data collection wave (DCW4). Information was missing for 18 children for ethnic group and for 543 children for SES. Recommended home nutrition-related behaviours were defined as: Family usually sit together for main meal everyday; Child always or mostly eats same food as parents; Mealtimes are mostly seen as time to talk to each other; Mealtimes are never rushed; Child eats a variety of food: everything or most things; Family mealtimes are mostly enjoyable; Child eats breakfast every day; TV is never or almost never on when child is eating.

### **Nutrition-related behaviours at licensed childcare services**

The most common nutrition-related behaviours in ECE settings were staff promoting water consumption, never using food as a reward or punishment, and staff sitting with children while they ate (Table 1). Two out of every three early education services reported baking or cooking with children at least weekly, and a similar proportion gardened with children at least weekly. The least followed RNB in the early education setting were staff always or mostly eating the same food as children, always talking to children about food at mealtimes, and never hurrying children to finish eating (Table 1). Staff always talking to children about food was positively correlated with four variables: encouraging water consumption ( $r=0.27$ ); always sitting with children to eat ( $r=0.26$ ); always or mostly eating the same food as children ( $r=0.16$ ); and gardening at least weekly ( $r=0.16$ ). Additionally, staff always sitting with children to eat was positively correlated with promoting water consumption ( $r=0.16$ ) and gardening at least weekly was positively correlated with baking at least weekly ( $r=0.22$ ). The average number of RNB followed by early education services was 4.8 out of 8, with large variation between services (Table 3). Kindergartens had proportionately greater

adherence to RNB, compared to community-based, privately owned centres, and playcentres. Services enrolled in the Heart Foundation's Healthy Heart Award had higher average adherence to recommended behaviours (but with large variation) (Table 3).

**Table 3: Average number of recommended nutrition-related behaviours<sup>1</sup> adhered to at early education service for 45-month-old New Zealand children**

Early education service characteristics		n	Mean (median)	Standard deviation	Range
Type of early childhood service*	Privately-run centre	91	4.8 (5)	+/-1.6	1-8
	Community-based centre	81	4.7 (5)	+/-1.6	0-8
	Kindergarten	49	5.5 (6)	+/-1.3	3-7
	Playcentre	31	4.3 (4)	+/-1.4	2-8
No. of students enrolled	0-29	38	4.6 (5)	+/-1.3	2-7
	30-49	93	5.1 (5)	+/-1.5	1-8
	50-69	71	4.7 (5)	+/-1.6	0-8
	70+	41	4.7 (5)	+/-1.6	1-8
District Health Board	Auckland	99	4.8 (5)	+/-1.6	1-8
	Counties Manukau	106	4.9 (5)	+/-1.4	1-8
	Waikato	52	4.8 (5)	+/-1.6	0-8
Teacher to child ratio	Low (1:1 to 1:5)	56	4.5 (5)	+/-1.5	1-8
	Med (1:6 to 1:8)	113	4.7 (5)	+/-1.7	0-8
	High (1:9 or more)	88	5.3 (6)	+/-1.3	3-7
Proportion of teachers fully qualified	Low (60% or less)	44	4.3 (4)	+/-1.4	1-8
	Med (61%-90%)	90	4.8 (5)	+/-1.7	1-8
	High (91% or more)	123	5.0 (5)	+/-1.5	0-8
Proportion of Māori and Pacific students enrolled	< 10% of roll	63	4.9 (5)	+/-1.6	1-8
	10 < 30% of roll	83	4.8 (5)	+/-1.5	0-8
	30 < 70% of roll	48	4.9 (5)	+/-1.5	2-8
	70% or more of roll	46	5.0 (5)	+/-1.6	1-8
Participating in Healthy Heart Award *	No	188	4.7 (5)	+/-1.6	0-8
	Yes	51	5.3 (5)	+/-1.5	1-8
Total		257	4.8 (5)	+/-1.5	0-8

\* =statistically significant difference between groups (chi square test) at  $p < 0.05$

Notes:

1. Data from Kai Time in ECE online survey, manager-reported about behaviours relevant to 3 and 4 year olds. Imputation was conducted for  $n=15$  services with missing nutrition behaviour variables, based on proportionate responses by type of service. Observations with missing data for demographics were excluded from analyses (less than  $n=18$  for each variable). Recommended early education nutrition-related behaviours were defined as: Staff always sit with children while they eat; Staff always or mostly eat same things as children; Staff always talk to children about food at mealtimes; Staff never hurry children to finish eating; Staff always encourage or promote water consumption; Staff never use food as a reward or deny food as a punishment; Children make, bake or cook food at least weekly; Children garden at least weekly.

## Concordance between nutrition behaviours in home and early education settings

Table 4 presents demographics for the cohort of children in GUiNZ ( $n=6211$ ) and the subsample of children used in analyses comparing home and early education nutrition-related behaviours ( $n=1181$ ). The children in the subsample all lived in New Zealand and all attended licensed out-of-home group-based childcare at 45 months (compared to 77.8% of the full cohort). Children in the subsample attended licensed childcare 1.3 hours a week less than the full cohort and mothers of children in the subsample were not statistically more likely to be in paid employment. They worked on average 28.8 hours a week, with 34% of mothers working 40 or more hours a week (Table 4). The homes of children in the subsample were slightly less likely to be in areas of high neighborhood deprivation, but there were still a sizeable number in each of the socio-economic position categories with which to conduct stratified analyses (Table 4).

There were no correlations in adherence between settings for the four RNB for which similar variables were collected in both settings, i.e. parent/teacher sitting with child for meals, parent/teacher eating the same food as child, parent/teacher talking to child at meals, parent/teacher not rushing child to eat (rho close to 1 for each pair). There was also no relationship between the number of RNB followed in a child's home and early education environment ( $p=0.17$ , Table 5, total in bold). Almost half of children from homes with high adherence to the RNB (7 or 8 out of 8 RNB) attended an early education service with low adherence to RNB (Table 5).

**Table 4: Characteristics of the study subsample compared with full Growing Up in New Zealand cohort at 45 months of age**

Variable <sup>1</sup>	Category	Growing Up in New Zealand cohort n (%)	ECE linked subsample n (%)
Gender	Male	3216 (51.8)	594 (50.3)
	Female	2995 (48.2)	587 (49.7)
Country of residence	New Zealand*	5913 (95.2)	1181 (100.0)
	Outside NZ	298 (4.8)	0 (0.0)
Socio-economic status (NZDep 2013) <sup>2</sup>	Low deprivation (deciles 1-3)*	1762 (31.1)	404 (35.3)
	Medium deprivation (deciles 4-7)	2064 (36.4)	390 (34.1)
	High deprivation (deciles 8-10)	1842 (32.5)	350 (30.6)
Main ethnic group child identifies with <sup>3</sup>	NZ European	3522 (56.9)	654 (57.9)
	Māori*	797 (12.9)	108 (9.6)
	Pacific (including Samoan, Tongan, Cook Island Māori)	791 (12.8)	135 (12.0)
	Asian (including Chinese, Indian, Fijian Indian)	869 (14.0)	140 (12.4)
	Other (including 'New Zealander', MELAA, British, Australian)*	214 (3.5)	92 (8.2)

Mother's highest education <sup>4</sup>	No secondary school Secondary schooling (NCEA 1-4) Diploma, trade certificate (NCEA 5-6) Bachelor's degree Higher degree	382 (6.2) 1400 (22.6) 1893 (30.6) 1483 (23.9) 1037 (16.7)	55 (4.8) 239 (20.9) 357 (31.2) 286 (25.0) 208 (18.2)
Mother's employment status <sup>5</sup>	In paid work Not in paid work and not seeking or unavailable to work <u>Unemployed and looking for work</u>	3963 (66.3) 1595 (26.7) 407 (6.8)	765 (66.7) 308 (26.9) 72 (6.3)
Main type of childcare at 45 months <sup>6</sup>	Privately-run childcare centre* Community childcare centre* Kindergarten* Playcentre (parent-run cooperative)* Kōhanga Reo (Māori cultural immersion centre)* Home-based (in carers home) Grandparent Nanny or au-pair Other relative or other person (including friend or neighbour) Other: casual education and care, unlicensed crèche or other specified No regular childcare at 45m	2387 (38.4) 1191 (19.2) 1007 (16.2) 115 (1.9) 133 (2.1) 189 (3.0) 83 (1.3) 63 (1.0) 22 (0.4) 383 (6.2) 290 (4.7)	401 (34.0) 418 (35.4) 317 (26.8) 40 (3.4) 5 (0.4) 0 0 0 0 0 0
Mean (SD, min-max) hours per week at licensed childcare service <sup>6*</sup>	21.2 (+/-11.7, 1-56)	19.8 (+/-11.1, 1-52)	
<b>Total</b>		<b>6211 (100)</b>	<b>1181 (100)</b>

\* =statistically significant difference between proportions (chi square test) or means (t-test) in full cohort and subsample at  $p <0.05$ .

#### Notes:

1. Childcare and country of residence is from the 45-month data collection wave (DCW4). Gender, ethnic group, mother's employment and NZDep2013 based on the home address are from the 54 month interview (DCW5);
2.  $n=37$  children were missing address information to calculate NZDep2013.
3. Self-reported by mother and prioritized according to Statistics New Zealand protocols.  $n= 52$  mother's refused or didn't know main ethnic group(s) child identified with.
4.  $n=16$  missing maternal education
5.  $n=246$  missing mother occupation
6. Based on mother reported main childcare service at 45 months of age. Licensed service type was confirmed or adjusted using 'Institution Type' in Ministry of Education's ECE Directory;  $n=345$  mothers refused to give name/location of main childcare service or not enough information provided on the name/location (i.e. Don't know/Refused) and  $n=3$  mothers did not answer the preceding question asking if their child was attending regular childcare.
7. Licensed childcare service = service institution type of private or community education and care centre, kindergarten, playcentre or kōhanga reo as listed on the Ministry of Education ECE Directory.

**Table 5: Adherence to recommended nutrition-related behaviours (RNB) for 45-month-old children<sup>1</sup> in the home and early education setting, by neighborhood deprivation<sup>2</sup>**

		Adherence to RNB in early childhood education service n (row %)			
Adherence to RNB at home		Low (≤4 RNB)	Moderate (5 or 6 RNB)	High (7 or 8 RNB)	Total n (col %)
All children	Low (≤4 RNB)	<b>130 (39.6)</b>	144 (43.9)	54 (16.5)	328 (27.8)
	Moderate (5-6 RNB)	207 (38.5)	<b>243 (45.2)</b>	88 (16.4)	538 (45.6)
	High (7-8 RNB)	148 (47.0)	122 (38.7)	<b>45 (14.3)</b>	315 (26.7)
	Total	485 (41.1)	509 (43.1)	187 (15.8)	1181 (100)
Low deprivation	Low (≤4 RNB)	<b>53 (28.8)</b>	57 (47.1)	11 (9.1)	121 (30.0)
	Moderate (5-6 RNB)	77 (44.8)	<b>72 (41.9)</b>	23 (13.4)	172 (42.6)
	High (7-8 RNB)	54 (48.7)	41 (36.9)	<b>16 (14.4)</b>	111 (27.5)
	Total	184 (45.5)	170 (42.1)	50 (12.4)	404 (100.0)
High deprivation*	Low (≤4 RNB)	<b>42 (40.0)</b>	37 (35.2)	26 (24.8)	105 (30.0)
	Moderate (5-6 RNB)	48 (30.2)	<b>79 (49.7)</b>	32 (20.1)	159 (45.4)
	High (7-8 RNB)	43 (50.0)	31 (36.1)	<b>12 (14.0)</b>	86 (24.6)
	Total	133 (38.0)	147 (42.0)	70 (20.0)	350 (100.0)

\* =statistically significant difference between group proportions (chi square test) at  $p < 0.05$ . Concordance between the two settings in bold.

Notes:

1. In a subsample of the Growing Up in New Zealand cohort for which information was collected from their main childcare provider at 45 months of age in the 2014 Kai Time in ECE Survey.
2. Measured using the New Zealand Index of Socioeconomic Deprivation (NZDep2013), low=deciles 1-3 (30% least deprived neighborhoods in NZ) and high=deciles 8-10 (30% most deprived neighborhoods in NZ). NZDep2013 data for households were missing for  $n=37$  children in the matched subsample (3.1%) and therefore excluded from these analyses. Pearson chi square  $\chi^2(4)=6.36$ ,  $p=0.17$  for all children;  $\chi^2(4)=3.33$ ,  $p=0.50$  for low deprivation;  $\chi^2(4)=12.79$ ,  $p=0.01$  for high deprivation.

### Nutrition-related behaviours by household socioeconomic position

In the full cohort, home RNB (low, moderate, high) adherence did not differ by neighborhood socioeconomic status ( $p=0.10$ ). Three of 10 children had low adherence to nutrition-related behaviours in the home at 45 months, and fewer than 1 in 10 had high adherence to nutrition-related behaviours at home (7.4%). One in five children living in areas of high deprivation attended an early education service with high adherence to RNB; more than the 12.4% of children living in areas of low deprivation ( $p=0.04$ ) (Table 5).

Table 5 describes concordance between adherence to RNB at home and early education, overall and separately for children in high and low deprivation areas. Children living in areas of high household deprivation with poor adherence to RNB were more likely to attend an early education service following RNB when compared to similarly deprived children with high adherence at home (24.8% and 14.0% respectively,  $p=0.01$ ). There was no statistically significant difference for children living in areas of low household deprivation, who were equally as likely to attend an early education service with low adherence to RNB irrespective of home behaviours ( $p=0.87$ ).

Using the framework outlined in the method section (Figure 2), 4% of children attend an early education service that supports the development of healthy behaviours that occurs in their homes, 11% attend an early education service that reinforces and legitimizes low adherence to RNB in their homes, 13% attend an early education service that potentially undermines the high adherence RNB in their homes, and 5% of children attend an early education service that possibly ‘protects’ them by promoting nutrition-related behaviours they are not exposed to at home. The remaining two-thirds of children attend early childhood services that are somewhat aligned with the moderate adherence to RNB in their home (Table 5).

## Discussion

This comparative analyses of adherence to recommended nutrition-related behaviours (RNB) in the home and childcare environments of  $n=1181$  preschool-aged children has not found support for the hypothesis that there is concordance between the two settings. Children living in homes following RNB were no more likely to attend early education services adhering to RNB, and half of children from homes with high adherence to RNB (irrespective of socioeconomic position) attended a service with low adherence. A recent review of parental childcare decision-making in the United States found that although ‘health and safety’ often featured in parents’ decisions<sup>(43)</sup>, this was due to concerns about ‘safety’ as opposed to nutrition or dietary practices which were generally not listed as key factors in decision-making<sup>(44)</sup>. Mothers of the children in the present study reported that they felt they had a choice when deciding which type of early childhood education to use ( $n=1040$ , 91.0% in DCW5). However, the top three reasons for choosing their child’s main childcare provider were unrelated to health or nutrition: location (15.8%), reputation of childcare provider (11.2%), and that it best suits work or studies (10.0%)<sup>(40)</sup>. Barraclough and Smith found high levels of parental choice and satisfaction with childcare services were not related to research-based measures of quality in early education services, and they suggest that “parents probably do not have knowledge to effectively evaluate quality and make critical choices”<sup>(45)</sup>.

The secondary hypothesis of this study was that children from homes with low adherence to RNB would attend an early learning service with greater adherence to recommendations and therefore have the opportunity to develop healthy behaviours, and potentially impact on their home food environments. This was the situation for 60% of children living in homes with low adherence (although the majority of these attended early education services with ‘moderate’ rather than ‘high’ adherence to RNB).

We also sought to determine if there were differences in adherence to RNB by socioeconomic position. In contrast to findings from the New Zealand Health Survey, GUINZ families in areas of high deprivation were no less likely to follow RNB at home. Although there was no difference in adherence to nutrition-related behaviours at home by socioeconomic position, children living in deprived communities were significantly more likely to attend an early childcare service that followed recommended practices. There was therefore potentially a “protective effect” for a quarter (24.8%) of children living in areas of high deprivation that experienced low adherence at home but attended an early childhood service with high adherence to RNB. By comparison, this protective effect only occurred for 9.1% of children living in areas of low deprivation with a low number of RNB at home. Interestingly, children living in homes with low adherence to RNB in areas of high deprivation were more likely to attend an early education service with high adherence to RNB when compared to similarly deprived children with high adherence at home. This may be due to the early education service responding to needs of children in their care, i.e. staff see that nutrition is a learning need for children attending and respond by improving the nutrition-related behaviours within their service.

Previous research analysing menus collected from New Zealand early education services found greater alignment with nutrition guidelines when services were located in areas of high deprivation<sup>(46)</sup>. After statistically adjusting for other service characteristics, the association with neighborhood deprivation could be attributed to greater participation in the voluntary Heart Foundation’s Healthy Heart Award program<sup>(46)</sup>. The association between adhering to guidelines for nutrition behaviours and the Healthy Heart Award was also evident in the data presented in the present study (Table 3). The Healthy Heart Award is voluntary and targeted to early education services in areas of high deprivation. As well as a menu improvement component, the program contains training for staff on eating behaviours, including water promotion, seated mealtimes, and talking to children about food<sup>(47)</sup>. Interventions for the prevention of obesity, such as the Healthy

Heart Award, have been proven to have the greatest effect when targeting children at high risk (i.e. children already overweight and of lower socioeconomic status)<sup>(48)</sup> and intuitively it is a commendable idea to target services where there is the greatest need in order to reduce inequity. However, the present study has found a need for greater support across the early children education sector to adhere with RNB, as over 40% of children attended childcare services with low adherence to the guidelines and a further 40% attended services with only moderate rather than high adherence, irrespective of household deprivation level.

It is a commonly expressed frustration of early education staff (including in New Zealand<sup>(39)</sup>) that many parents do not follow best nutrition-related practices at home<sup>(49-53)</sup>. For the staff in early education services with high adherence to RNB, only one out of every four children in their care ( $n=45/187$ , 24%) experienced high adherence to RNB at home. However, it was a minority of services that had high adherence themselves. Notably, the majority of caregivers in both settings reported that children were sometimes rushed to finish eating. Parents and teachers may find it difficult to schedule seated, conversational and slow-paced lunch and snack-times, but rushing a child when eating over-rides their internal satiety cues, which can lead to overeating or not eating enough quantity or variety of foods, exacerbating fussy eating. The US Academy of Nutrition and Dietetics warn against a nonresponsive feeding approach (which includes both pressuring a child to eat and uninvolved feeding) as this is associated with excess weight gain<sup>(54)</sup>.

The strength of this study is that it utilizes information from a sizeable subset of children involved in the largest longitudinal cohort study in New Zealand, for whom we had additional information from each child's main childcare service. Previous research comparing nutrition-related aspects of the home and early education or childcare environments for young children has generally focused on differences in dietary intake between the two environments<sup>(55)</sup> and this is the first we are aware that compares a range of nutrition-related behaviours. Limitations of the study include that behaviours were self-reported and thus potentially affected by social desirability or recall bias. Also, not all nutrition-related behaviours were included in GUINZ and Kai Time in ECE, both of which covered a wider range of topics. Future research focusing on eating behaviours in the home should also include robust measures of parental role modeling<sup>(6,56)</sup>, routines<sup>(19,57,58)</sup> and parental feeding style<sup>(59-61)</sup> as these are emerging in the literature as important predictors of dietary and body size outcomes. A final limitation to note is the modest response rate in the online Kai Time Survey of 30%. Although the Kai Time sample was proportionately similar to the total population of

licensed childcare services within the regions surveyed, we cannot be certain that the Kai Time data is unaffected by non-response bias<sup>(39)</sup>.

## Conclusion

This paper has explored adherence to recommended nutrition behaviours (RNB) within the home and centre-based childcare for a large sample of children aged 45-months-old. Nutrition-related behaviours with the lowest adherence in the home were eating with the television on and hurrying children to finish eating. Less than half of early childhood education services followed recommendations for role modeling healthy eating, talking to children about food during mealtimes and not hurrying children to finish eating. Only a small number (4%) experienced high adherence to RNB in both their home and early education environment, and no relationships were found between adherence to RNB in a child's home and early education service. Some children in the present study attended an early education service that may be undermining healthy eating behaviours at home, or reinforcing or legitimizing unhealthy behaviours learned at home. Children from communities with high levels of deprivation were significantly more likely to attend an early childcare service following recommended practices; a quarter of children living in disadvantaged communities experiencing low adherence to RNB at home attended an early education service with high adherence, thereby possibly conferring a 'protective' effect. This research points to a need for more widespread assistance for the early education sector to provide health-promoting environments for young children.

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